

# ALUMINUM

## Success Story



## INDIRECT-FIRED, CONTROLLED ATMOSPHERE DECOATING OF ALUMINUM SCRAP

### Indirect-Fired Kiln Turns Aluminum Scrap into Valuable Feedstock

#### Benefits

- ◆ Energy savings of 55% over conventional kiln decoating
- ◆ Through 2000, the cumulative energy savings have been over 500 billion Btu
- ◆ Improved product quality and decreased operating cost compared with a conventional kiln
- ◆ Through 2000, the cumulative cost savings due to reduced natural gas usage are over \$1.8 million
- ◆ Reduced air emissions resulting from reduced energy use and VOC production
- ◆ Through 2000, the cumulative reduction in CO<sub>2</sub> emissions has been over 32,000 tons
- ◆ Reduced solid-waste disposal because of reduced waste and oxidized product

#### Applications

This technology is applicable to the secondary aluminum industry that processes both scrap from the manufacturing process and used aluminum. IDEX kilns may also be used when processing other materials such as fiberglass, which contain organic binders

A critical part of the aluminum recycling process is the removal of organics (such as oil, rubber, plastic, lacquer, and paint) from the scrap aluminum before the melting step. Proper organics removal, called decoating, has a great impact both on the quality of the final recycled aluminum and on the energy use and emissions generated during the process.

To improve the traditional decoating process, the Energy Research Company (ERCo), teamed with Wabash Alloys (formerly Roth Brothers Smelting Corporation), the U.S. Department of Energy's National Industrial Competitiveness through Energy, Environment, and Economics (NICE<sup>3</sup>) Program, and the New York State Energy Research and Development Authority (NYSERDA) to demonstrate a system to decoat aluminum using an indirect-fired, controlled atmosphere kiln called IDEX™. The IDEX decoater was installed at Roth Brothers, a secondary aluminum processor, in January 1997.



Indirect-Fired IDEX kiln

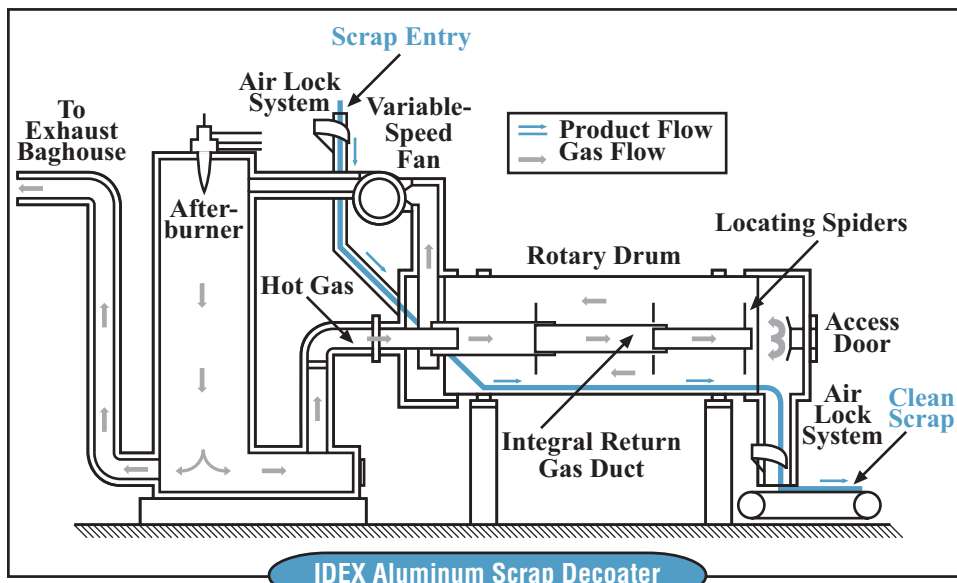




## Technology Description

By design, the IDEX differs from the traditional decoating process because of its ability to eliminate the various organics typically found in scrap aluminum. Because of incomplete combustion, traditional decoating processes usually have difficulty processing solid organics, such as rubber, plastics, or high levels of oil or paint. As a result, unprocessed organics are fed into the furnace (along with the scrap), where they vaporize and contaminate the scrap. The contaminated portion of the melted aluminum then must be removed as waste or dross. In addition, once in the furnace, the organics result in increased volatile organic compound (VOC) and particulate production and emissions.

To eliminate the introduction of these organics into the furnace, the IDEX first decoats the scrap in a low-oxygen, controlled atmosphere rotary kiln (see figure below). The scrap enters the kiln through an air lock. The combination of the kiln rotation and the internal baffles (locating spiders) disperses the scrap throughout the kiln. The scrap stays in the kiln about 15 to 20 minutes. Gases at 1,500°F enter the kiln's center tube, flow parallel to the scrap, then reverse direction after exiting the center tube. The heat of the gases vaporizes the organics in the scrap in the kiln; but because the oxygen in the kiln is kept below the lower flammability limits of the organics, no combustion takes place in the kiln.



"This is a win-win situation... our business is very competitive; this process helps us jump ahead of our competition, while at the same time providing a cleaner, safer working environment as well as superior product at a reduced cost"

– Neal Schwartz  
Former General Manager  
Wabash Alloys  
(Formerly Roth Brothers  
Smelting Corporation)



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#### Project Partners

- ◆ Energy Research Company  
(ERCo)  
Staten Island, NY
- ◆ New York State Energy Research  
and Development Authority  
(NYSERDA)  
Albany, NY
- ◆ Wabash Alloys  
(formerly Roth Brothers  
Smelting Corporation)  
Syracuse, NY

After vaporization, the gases are passed from the kiln to an incinerator (afterburner) to elevate the temperature. In this environment, the organic vapors are allowed to combust; this process not only destroys the VOCs but also releases a significant amount of heat. A portion of these gases is now recirculated to the kiln to provide heat to drive the kiln vaporization process. The remainder is directed to the baghouse for final processing.

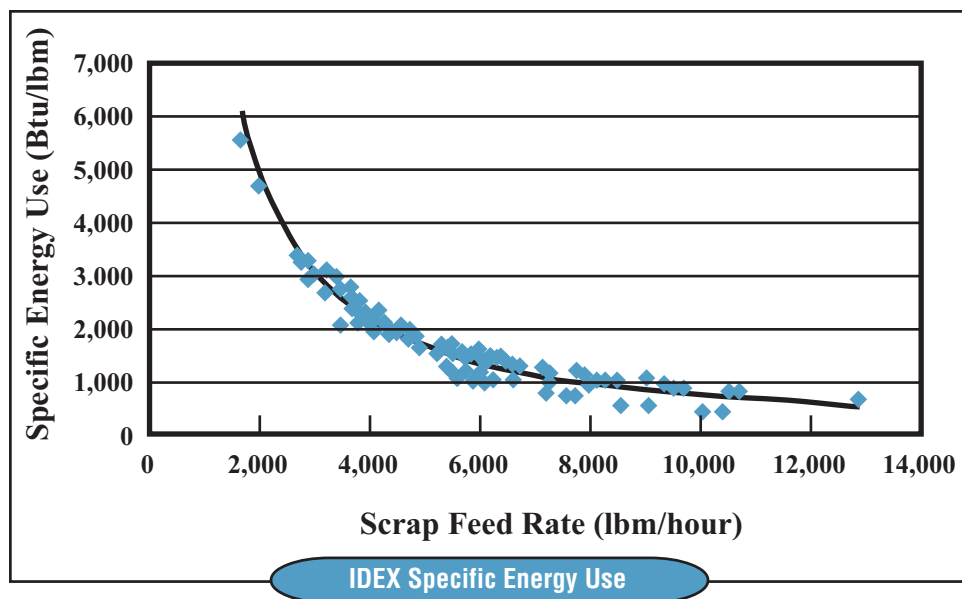
## Technology Benefits

### Energy Savings

The figure below shows the measured specific energy use of the IDEX at Wabash Alloys as a function of scrap feed rate. Testing at Wabash revealed an energy savings of 55%, or about 450 Btu per pound of mass (Btu/lbm), over conventional equipment. Furthermore, the scrap is at 628°F after being processed by the IDEX; if this hot scrap is fed into the furnace, an additional energy savings of 370 Btu/lbm is possible, for a total savings of 820 Btu/lbm.<sup>1</sup> If air leaks are eliminated (there was significant air leakage at Wabash Alloys during the demonstration) and preheated scrap is used, this technology is estimated to save more than 1,200 Btu/lbm.

As of 2000, the two IDEX installations operating in the U.S. have saved over 500 billion Btus.

<sup>1</sup> Because of scheduling problems, Wabash Alloys does not feed the scrap immediately into the furnace and therefore does not take advantage of the preheating.



### Scrap Metal Loss Reduction

When furnace measurements were taken with the IDEX making up only 20% of the furnace feedstock, metal loss was reduced from 8.2% to 7.5%. While there is general agreement that the IDEX will produce metal savings, a parametric test of the savings was not done as part of this demonstration.

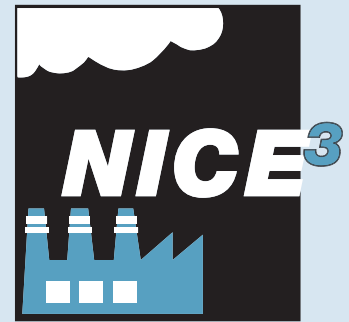
Neal Schwartz, who was General Manager of Roth Brothers at the time of the installation, said, "The quality of the scrap that comes out of the IDEX is much much better... (when) we were using the older technology, scrap would burn and smoke... now we get better product and there is no smoke at all, and we are really very happy with it."

### Emissions Reduction

Emissions measurements from the IDEX were taken by Galston Measurement of Syracuse, New York. Nitrogen ( $\text{No}_x$ ), sulfur dioxide ( $\text{SO}_2$ ), VOCs, and particulates were measured at 19%, 2%, 2%, and 6%, respectively, of allowable New York State Department of Environmental Conservation standards.

### Commercialization Success

The IDEX located at Wabash Alloys has been in operation since 1997. IDEX units also have been installed in Plymouth, Indiana; Brazil; Holland; Mexico; South Africa; and Japan. With its energy efficiency, increased metal recovery, compliance with environmental standards, and ability to accept a wide range of scrap materials, the IDEX technology is expected to increase its installed base in the U.S. and abroad.



**NICE<sup>3</sup> – National Industrial Competitiveness through Energy, Environment, and Economics:**  
An innovative, cost-sharing program to promote energy efficiency, clean production, and economic competitiveness in industry. This grant program provides funding to state and industry partnerships for projects that demonstrate advances in energy efficiency and clean production technologies. Awardees receive a one-time grant of up to \$525,000. Grants fund up to 50% of total project cost for up to 3 years.

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